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Factors of successful diversification for machine-building enterprises

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Abstract. The relevance of the study is due to the need to diversify production in order to increase competitiveness and strengthen the economic sustainability of enterprises. Increasing the output of high-tech civil and dual-use products by enterprises of the military-industrial complex as part of the conversion is complicated by the lack of enterprises work experience in the market. Conversion of defense industry enterprises is an important and promising task, the solution of which is connected with the future of defense industry enterprises, the development of import substitution, the expansion of high-tech exports. The purpose of the study is to analyze the world experience of conversion, to study existing approaches to solving conversion implementation problems, creating a system of conversion success factors, monitoring the effect of external and internal conversion implementation factors, identifying actual problems of this process. The author's approach to solving conversion problems consists of identifying external and internal conversion success factors and combining them into a single system for the interaction between the state and defense enterprises. The study of the implementation of the indicated factors showed the degree of their development, as well as the directions that will contribute to the development of diversification.

1. Introduction

The development and improvement of the competitiveness of the Russian machine-building industry in recent years is closely related to the problem of production diversification. The country's leadership considers diversification as the basis for strengthening the economic sustainability of enterprises in the conditions of cyber threats, other risks, currency fluctuations [1]. Special attention in the state policy is paid to the conversion of defense enterprises, which determines the future of defense industry enterprises, the development of import substitution, the expansion of high-tech exports, the development of domestic industry and the economy.

In a message to the Federal Assembly in 2016, the President of the Russian Federation instructed the Government to increase the share of high-tech civilian and dual-use products in the total volume of products manufactured by organizations of the defense industry complex, by 2020 not less than 17 percent, by 2025 not less than 30 percent, by 2030 - no less than 50 percent [2].

2. World conversion experience

The successful experience of world-powers in the field of military production diversification can be the basis for making strategic decisions in the production of civilian products of Russian defense industry enterprises. Therefore, it is very important to analyze the existing experience, highlighting the



steps that contributed to increasing the share of civilian and dual-purpose products and allowed enterprises to reduce their dependence on state defense order fluctuations.

The widest diversification of military production is peculiar to enterprises of the United States, Western European countries, China, Japan, and South Korea. The study of the experience of conversion in the United States, China and Sweden [3–9] made it possible to identify the characteristic features of each conversion carried out.

One example is the successful experience of diversifying China's military enterprises. Conversion in China can be divided into 3 main periods: from the mid-1980s, in the 1990s and in the 2000s. Here are the factors common to these periods that had a positive impact on the development of civilian production in military enterprises:

1. availability of production facilities for the production of civilian products;
2. presence of a state conversion program;
3. financial state support of conversion programs (enterprises received large loan and investment resources from national commercial banks at favorable rates for them, compensated by the state);
4. government management of conversion (the creation of a commission on science, technology and industry in the interests of defense, which was entrusted with the task of converting military production);
5. territorial restructuring (many enterprises were moved closer to transport hubs and major cities);
6. the establishment of a new structure of the defense industry (11 market-oriented large associations of the Chinese military industry have emerged);
7. production of cheap consumer goods of low quality for export;
8. favorable external economic situation, cooperation with military-industrial corporations of various countries;
9. huge domestic demand;
10. provision of declassification and technology transfer (in the mid-1990s, the Chinese government ordered the declassification of 2,237 advanced scientific and technical developments of the defense complex for use in the civilian sector);
11. cooperation (integration of defense industry enterprises and technologically advanced civilian companies and enterprises).

The combination of favorable factors for the development of civilian production has led to an excess of the expected share of civilian products in the revenues of military enterprises. The share of civilian goods in the gross output of the defense enterprises of China reached 80% at the beginning of the XXI century. All the military-industrial corporations of the People's Republic of China without exception work in the civil sphere [6].

As a conclusion, it should be noted that it is necessary to create industries capable of concentrating the main power on civilian output in peacetime, and quickly switching to the needs of the armed forces during the war. Therefore, new industrial technologies introduced in civil, double and former military production should contain the possibility of accelerated reconversion. This trend of industrial development is typical for many countries that have successfully completed the conversion.

3. Shares of civilian products of the world's largest companies included in the rating Top 100 arms-producing and military services companies SIPRI

In December 2018, the Stockholm International Peace Research Institute (SIPRI) published the “Top-100 largest military-industrial companies in the world” rating by sales volume in 2017 (both in domestic and foreign markets). The arms sales of 10 Russian companies in the Top-100 amounted to \$ 37.7 billion in 2017, which accounted for 9.5% of the total arms sales in the Top 100 [10].

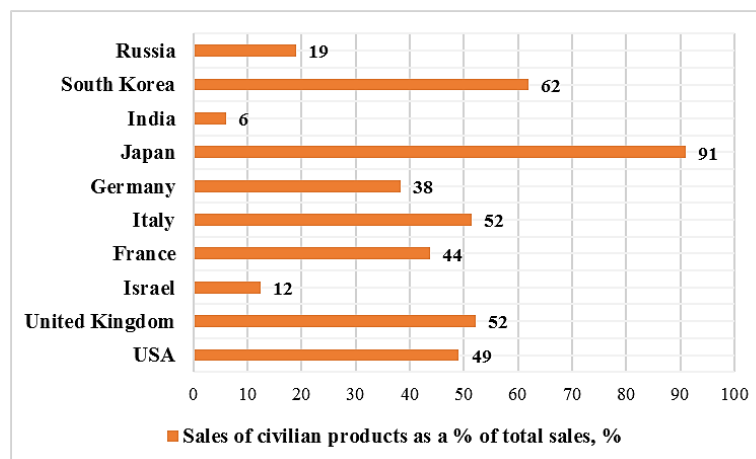
The current situation in the global market for military-industrial enterprises shows a profound diversification of the leading military enterprises (see Table 1).

Table 1. Shares of civilian products in the output of foreign enterprises according to the rating SIPRI (2017)

Company	Country	Rank	Sales of civilian products as a % of total sales
Lockheed Martin Corp.	USA	1	12
Boeing	USA	2	71
Raytheon	USA	3	6
BAE Systems	UK	4	2
NorthropGrummanCorp.	USA	5	13
GeneralDynamicsCorp.	USA	6	37
AirbusGroup	Trans-European	7	85
Thales	France	8	49
Leonardo	Italy	9	32
Almaz-Antey	Russia	10	6
United Technologies Corp.	USA	11	87
L-3 Communications	USA	12	21

Almaz-Antey, which produces advanced air defense systems (such as the S-400), is the first Russian company to enter the Top 10 since SIPRI began to include Russian companies in its Top 100. The average share of civilian products in the total revenue from sales of the ten Russian military companies included in the Top 100 rating in 2017 is 19%.

According to the SIPRI rating, the largest Russian military enterprises have one of the lowest average shares of civilian products in revenue compared to military-industrial enterprises of other countries (see Figure 1).

**Figure 1.** The average level of the civilian products sales share in the proceeds of the world's largest military enterprises in 2017

Thus, the average civilian products sales share of the largest US military enterprises in 2017 was 49%. The highest level of civilian products sales in revenue (91% on average) is observed at Japanese military enterprises (data on Chinese military enterprises are not taken into account in the Top-100) [10]. South Korean military companies rank second with a civilian products sales share of 62%.

4 Existing approaches to the actual conversion problems solving

Civilian products require a different approach to production: studying the needs of the market, designing at a given cost, more careful cost control, maximum production flexibility, readiness for tough competition, establishing effective service, etc.

The study of publications on conversion problems led to the conclusion that there is no systematic approach to their solution. Most of the authors' opinions boil down to the classification of the enterprises of the military-industrial complex and then to defining the features and characteristic problems for each selected group. The authors of publications [5, 11, 12] identified several variants of classifications. The first option is to divide defense enterprises into three conditional groups according to the share of civilian products in the total output: defense enterprises that don't fit into civilian markets, with a share of civil products $<10\%$ and $>25\%$.

The second option is to divide all the enterprises of the military-industrial complex into two types according to the presence of dual-use technologies.

- Companies of the first type rely on dual-use technologies, which can be used for civilian products after the revision, so that its share can reach up to 30% - 50%.

- Companies of the second type are based on technologies specific to military products, such companies are widely diversified by type of weapons, but their share of civilian products is 5–10%.

The historical diversification scheme in our country (see Figure 2) is recognized as a certain brake on the development of diversification and civil-military integration, which is carried out in the following sequence:

1. the creation of a new technology;
2. introduction of technology in the field of complex, high-tech military products;
3. the introduction of technology in the field of less complex civilian products;
4. production of cheap mass products.

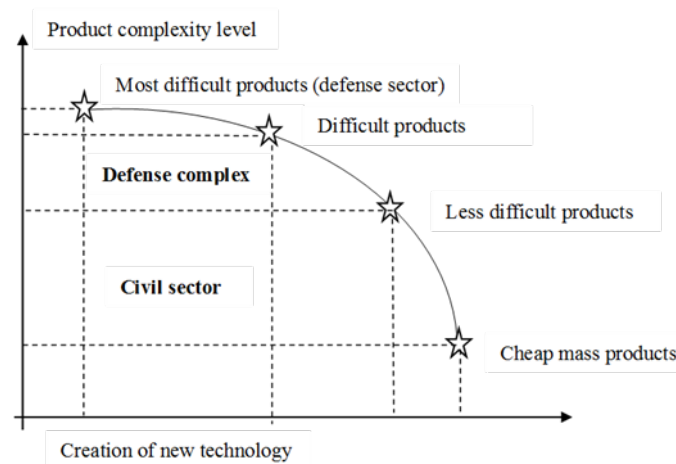


Figure 2. The traditional approach to diversification

That is, the generation of high technologies is due, above all, to the interests of defense, and only after ensuring that these technologies can be extended to civilian and dual-use products. In developed countries high technologies are initially created taking into account the possibility of their commercialization. The entire system of relations between the state and defense-oriented enterprises has been built accordingly [13].

As for the foreign experience of conversion, Malkov A.S. has shown [14] the following main approaches to the diversification of foreign military companies' production:

1. production of civilian products based on existing intellectual property (dual-use developments) and using existing production assets;
2. the provision of engineering services - laboratory research, calculations, design, development work in the interests of third-party customers;
3. sale of non-core technologies - separation of a part of a business or technology into a separate company for the commercialization of developments and, as a rule, for the purpose of subsequent sale (spin-off);

4. contract manufacturing - the execution of third-party orders using existing production capacity based on the provided intellectual property;
5. public-private partnership - long-term interaction of the state and business;
6. adaptation of military developments (intellectual property) for commercial use.

Based on the analysis of approaches to the foreign companies diversification, one can see that the production of high-tech civilian and dual-use products is not the only way to expand the product portfolio. Highly specialized military enterprises can provide design services, R & D, laboratory research, machining, casting, commercialize technologies for subsequent sale.

5. The system of factors for successful conversion and monitoring of their implementation

The organization of the conversion process by enterprises of the military-industrial complex is the most important task requiring a strategic approach, an understanding of markets and competitors, and their own competencies and capabilities. However, the lack of operational experience of defense industry enterprises in the market conditions can cause serious difficulties for the successful implementation of the conversion transition, due to the fact that the approach to the process of military production differs sharply from the approach to the civilian production. For military enterprises it is a separate investment project that requires appropriate qualifications, system approach and financing [15].

The efficiency of the conversion is influenced by both government regulation and the readiness of production facilities, the availability of design, management and marketing competencies for organizing production and bringing products to the civilian market.

The purpose of the research conducted by the authors of the article is to create a complete system of factors determining the success of the machine-building enterprises diversification process in modern conditions. For defense enterprises, one of the options for diversification is conversion. Currently, there are no developments of a factors system affecting the success of the diversification process, and in particular, conversion.

The hypothesis of the authors of this work is based on the assumption that it is necessary to ensure the interaction between the state and the enterprise in this process. Therefore, it was proposed to identify and classify two groups of factors: external and internal [16]. The external factors include: the presence of the state program and state support: financial, informational, organizational, regulatory (see Figure 3).

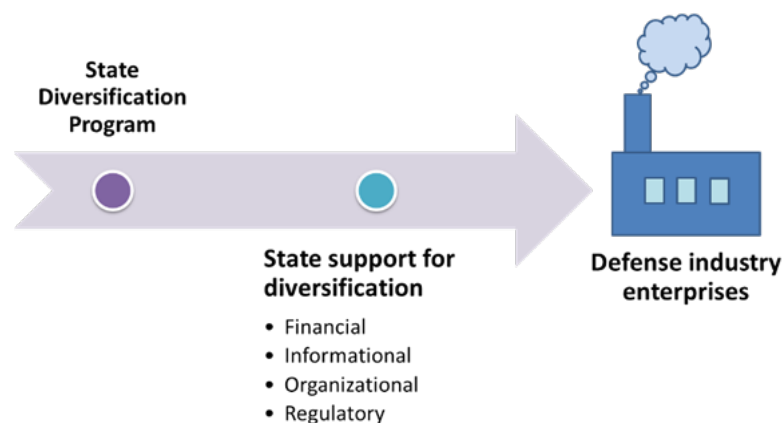


Figure 3. External success factors of conversion

The implementation was monitored for each selected external success factor, and it was shown that the work has been started not in all of the selected areas at that moment. Let us give some examples of the current situation regarding the implementation of factors independent of the enterprise's activities.

❖ *Presence of the state diversification program*

At the moment there is no government program for defense industry enterprises diversification, which would set the conditions for its implementation, determine the timelines and indicators that need to be achieved in individual sectors of the defense industry or by the basic military concerns, indicate the government support measures under this program, based on the analysis of technological and production capabilities of the defense industry enterprises for civilian production. As stated by the Deputy Prime Minister of the Russian Federation on issues of the defense-industrial complex, Yu.I. Borisov, a program to diversify defense enterprises can be developed by 2023 [17].

❖ *State support*

As an example of state support, we present monitoring results for a group of factors: “state financial support” (see Table 2).

Table 2. Examples of the implementation of factors of the group «financial support of the State»

External success factors	Examples of the implementation of factors	Results / Implementation plans
<i>tax breaks</i>	Special Investment Contract (SPIC)	In 2017 the defense industry enterprises received more than 5 billion rubles from the federal budget, and the defense industry enterprises of the Urals received 1.5 billion rubles out of them [18]
<i>support funds, targeted programs and support measures</i>	Russian Export Center (REC)	In 2017 the REC was allocated about 30 billion rubles on export support. In the first five months of this year, non-commodity and non-energy exports of the Russian Federation increased by more than 16 percent, reaching \$ 45.5 billion [19]
<i>reduction of the credit load on the defense industry enterprises</i>	Preferential loans provided by the Industry Development Fund (IDF)	In 2017 the IDF financed 98 projects from 55 regions of the Russian Federation for a loans' total amount of 21.7 billion rubles. Under the “Conversion” program, 4 projects with a total value of 4.2 billion rubles were approved by the IDF, 1.9 billion rubles of which were the IDF loans. The IDF approved 10 projects under the program “Components” with a total value of 5.9 billion rubles, 2.7 billion rubles of which were the IDF loans [20]
<i>provision of subsidies</i>	Subsidizing part of R&D costs	In April 2018 the stage of accepting applications for participation in the tender for R&D costs reimbursement grants up to 100%, regulated by the Government of the Russian Federation Decree No. 1312, was completed. Planned budget for the implementation of this measure for the period of 2018-2019 is 9.1 billion rubles. 100 applications were received from the defense industry enterprises [21]
	Interest rate subsidies for the implementation of new investment projects	Decree of the Government of the Russian Federation No. 3 of January 03, 2014. The Ministry of Industry and Trade has already supported 121 investment projects in 42 regions of the country for 8.1 billion rubles [20]

The internal factors of successful conversion were classified into 7 main groups according to their functional characteristics, and were divided into three groups according to the degree of use at the enterprises of the military-industrial complex as a result of their implementation monitoring: used, partially used and unused. This division is conditional, but is typical for most enterprises [15]. The

study of the situation showed that most of the indicated internal factors are absent in military enterprises. For each enterprise of the military-industrial complex, these factors have a different degree of study and determine its current readiness for the production of high-tech civilian products. Therefore, enterprises need to conduct a preliminary assessment of their ability to carry out the conversion. The presence or absence of these competencies will determine the need to find external business partners for marketing research, project financing, sales and service organization and other needs.

The system of conversion success factors will allow to solve the following actual problems of conversion for modern Russian defense industry enterprises were highlighted in the process of studying publications on conversion, materials of military-industrial conferences, meetings of the defense industry enterprises heads:

- lack of financial resources;
- the need for marketing research;
- low motivation of enterprise management;
- dynamic civilian markets;
- inability to form a technological request;
- the problem of counting and sharing costs;
- barrier to cooperation;
- the complexity of the information search on existing measures of state support for the conversion process;
- declassification and technology transfer.

For successful conversion, it is necessary to establish the effective work of the state and military enterprises on issues of existing programs and support measures, both at the regional and federal levels, for the successful implementation of the conversion. In turn, the main task of defense enterprises is to use the opportunities provided in a timely manner; therefore, constant interaction between the state and military enterprises is necessary to use effectively all the support tools for the conversion transition. Thus, the optimal result of diversification will be obtained with the simultaneous active use of external and internal factors by the enterprise.

Analysis of the external factors implementation showed that for many factors there are support measures, but for some factors there is no data on the start of work on their implementation (for example, work to improve the legislation on regulation of intellectual property management and technology transfer to stimulate an increase in the number of intellectual activity results and their use in the production of civilian products). Work has just begun on one of the important areas - the publication of a law stimulating the sale of civilian products, in order to create a level of demand that ensures sufficient profitability of production. Analysis of the implementation of the conversion internal success factors will allow determining the level of competencies necessary for the implementation of the conversion transition and making an effective management decision in a timely manner. In turn, monitoring external factors for success in conversion will allow the use of existing support tools to develop the competencies required by conversion.

Awareness of defense enterprises on the existing support measures and the procedure for their use will help to build a system of interaction between enterprises and the state to solve actual conversion problems.

6. Conclusion

Conversion as a direction of production diversification is typical for economies of various countries. The key to its success are well-thought-out government policies, the preparation of legislation and conversion programs, the search for ways to re-engineer production that would be most effective and efficient, the identification of popular types of high-tech products for production, and financial support for conversion projects.

The study of conversion experience leads to a number of conclusions:

1. The organization of the conversion process is the most important task requiring a strategic approach, an understanding of markets and competitors, own competencies and capabilities. Defense industry enterprises differ in the possibility of diversification; therefore, the importance of success factors for each enterprise at a particular moment may also vary.
2. For each enterprise of the military-industrial complex, the designated internal factors have a different degree of study and determine its current readiness for the release of high-tech civilian products. Therefore, enterprises need to conduct a preliminary assessment of their ability to carry out the conversion. The presence or absence of these competencies will determine the need to find external business partners for marketing research, project financing, sales and service organization and other needs for interaction.
3. The formation of a system of external and internal success factors creates the conditions for interaction between the state and the enterprise for the effective implementation of conversion and the achievement of strategic goals.

The proposed approach to solve the country's goal of increasing the production of high-tech civilian and dual-use defense enterprises, which consists in identifying the key success factors common to all defense industry enterprises, has a certain amount of novelty and can have a positive impact on practical activities in the framework of the conversion. Monitoring the formation of a factors system at the level of the state, the region and a particular enterprise allows the enterprise to choose its own path to diversification. Summarizing the experience of defense industry enterprises allows us to identify and solve the pressing problems of the development of industries and the economy as a whole.

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